

GEOPHYSICAL MODEL OF BEDDED BARITE

COX AND SINGER Model No. 31b

Geophysically similar models-31a sedimentary
exhalative Zn-Pb.

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A. Geologic Setting

Hosted within marine fine grained, typically siliceous or carbonaceous, sediments usually of Proterozoic or Paleozoic age.
Stratabound deposits of limited areal extent related to exhalative processes controlled by high angle faults along which metal-rich brines were released to sea water.

B. Geologic Environment Definition

Geophysical methods appear to have had very limited application on a regional scale for old marine basins in which bedded barite deposits are found. However, airborne methods could have application to mapping of lithologies and structures, especially where cover or access present difficulties to conventional regional mapping. Barnes and Kelley (1991) note that 12 of 3500 gravity stations comprising a regional survey in Alaska need to be reexamined. These 12 stations, showing 2-4 mgal highs, had been rejected when compiling the regional map as due to simple errors or related to shallow sources. The shallow sources could possibly be bedded barite deposits.

C. Deposit Definition

All conventional geophysical methods have been tried over bedded barite deposits but only two, gravity and electrical resistivity, methods have proven very effective. Gravity is most used due to the large density contrast between ore and host (+1.0 to 2.0 gm/cm³ reported). Maximum anomalies at Mangampetta North and South, India, and Red Dog North, Alaska; three of the largest deposits are 2.1, 1.6, and 4.07 mgals respectively (Bose, 1980; Barnes and Morin, 1982; Barnes and others, 1982). Small deposits become difficult to identify with gravity methods because of limitations due to geologic noise (Bhattacharya and others, 1974; Miller and Wright, 1983; Moro, 1982; Parker, 1980; Visarion and others, 1974). Although, in favorable areas even small deposits may be identified (Uhley and Scharon, 1954).

Bedded barite deposits, like many other chemical sediments, are expressed as high resistivity units. Where these are hosted within carbonaceous or sulfide-bearing sediments, the resistivity contrast may be very large (Parker, 1978, 1980; Rao and Bhimasankaram, 1982; Bhattacharya and others, 1974). I.P. methods were used at the Mel deposit, Yukon territory, Canada (Miller and Wright, 1983) providing good definition because of the high sphalerite/galena content. Intrinsic chargeability was 60 msec from modeling. Moro (1982) presents S.P. results at the Ambiciosa mine, Spain, showing 100+ mv anomalies, but these are related to sulfide-and graphite-bearing host schists.

Magnetic methods are mentioned by Scull (1958), Vasserman and others (1980), Bose (1980), and Parker (1980) tried them at Aberfeldy, Scotland but results were inconclusive. Bose (1980) states that seismic refraction was tried but gives no results.

Scull (1958) using a total-count scintillometer across the Chamberlain Creek syncline noted that barite and associated black shales had low radioactivity contrary to expectations. He suggested airborne scintillometry could be an effective tool. However, many deposits show a sericite alteration zone (Papke, 1984) which might provide a target for gamma-ray spectrometry. Vasserman and others (1980) note that natural gamma-ray logs show a minimum, in barite ore. Zimovets (1984) gives results for natural gamma-ray and gamma-gamma logs showing excellent correlation between each and low values for natural gamma and high values for gamma-gamma logs. Using these logs quantitative estimates of barite content could be obtained.

D. Size and Shape of Deposit	Shape	Average Size/Range
	lense	individual lenses 0.1 to several meters thick. Interbedded units up to 100 m thick. Strike length typically several 100s of meters but may be discontinuous up to 7 km. Volume 29-6800 m ³ , ave. 440 m ³

E. Physical Properties (units)	Deposit	Alteration	Cap	Host
1. Density (gm/cm ³)	2.86-4.42; 4.1 ^(1,2,3,7,12,15,16)	?	N.A.	*
2. Porosity (%)	0.5-5% ⁽¹⁵⁾	?	N.A.	*
3. Susceptibility (cgs)	very low-low	low	N.A.	*
4. Remanence	low	low	N.A.	*
5. Resistivity (ohm-m)	850 ⁽¹²⁾ - 1400 ⁽⁷⁾ 1000 - 1,000,000 ⁽¹⁵⁾	?	N.A.	*
6. IP Effect (msec.)	60 ⁽⁷⁾	?	N.A.	*
7. Seismic Velocity	high	?	N.A.	*
8. Radioelements				
K (%)	low	medium?	N.A.	*
U (ppm)	low	low?	N.A.	*
Th (ppm)	low	low?	N.A.	*

F. Remote Sensing Characteristics

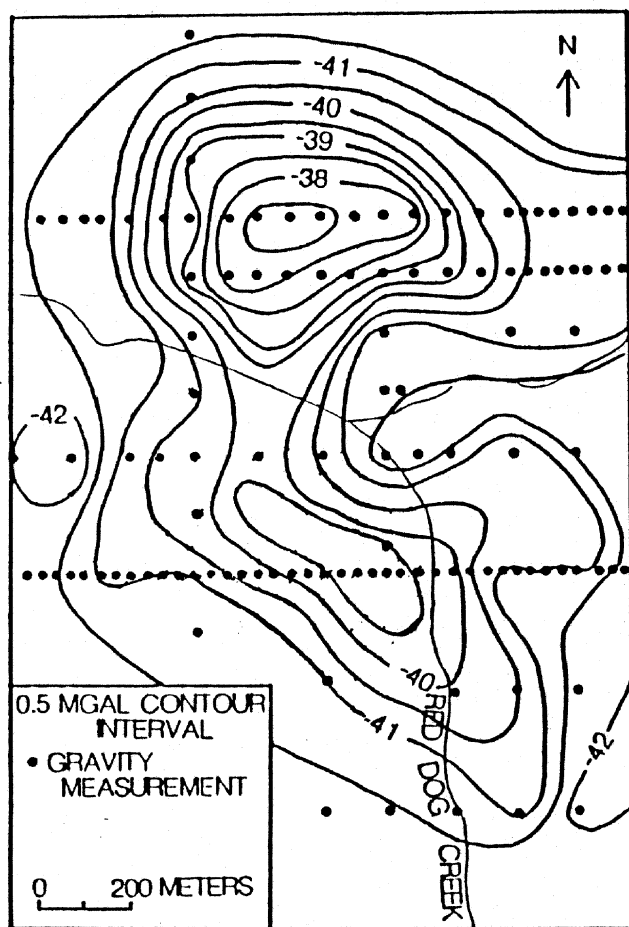
No literature references to remote sensing techniques applied to barite exploration have been found. However, in some cases such methods may be relevant to lithologic, structural, and possibly alteration mapping in exploration for barite. In the visible and near infrared region the barite spectrum is featureless.

G. Comments

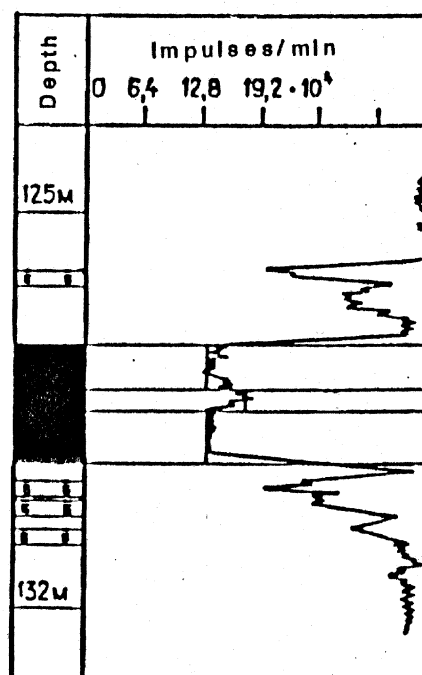
Because of the small average size and limited alteration haloe, if present, detailed surveys are required at the deposit scale. It is unlikely that airborne surveys would be of much help in deposit definition. A USGS AEM and gamma ray 400 m spaced survey in the Osgood Mtns., Nevada showed no definitive high resistivity body over the Barum deposit, nor a characteristic radioelement signature.

H. References

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A



B

Figure 1. A. Gravity contour map of the Red Dog deposit Alaska, adapted from Barnes and Morin (1984). B. Gamma-gamma log from a barite deposit in the northern Urals, adapted from Zimovets (1984).